**STO 101/00/WO**

Applicant: Stora Enso Maxau GmbH & Co. KG

# Wallpaper base and Method for the Production Thereof

The term wallpaper base (or "body paper for wallpaper") is commonly used for paper processed by wallpaper manufacturers by means of printing or other surface modification to produce a wallpaper. The paper must have several properties that are important for wallpaper manufacture, such as, for example, good printability and a firm, closed surface. Further it must not generate dust.

In particular, the invention refers to a wallpaper whose wet expansion is sufficiently low to render it suitable for a wall covering procedure, in which aqueous wallpaper adhesive is applied to the wall rather than the wallpaper ("paste the wall"). This type of wall covering procedure is simpler and does not require any soaking time, but requires that the wet expansion (expansion of a water-saturated paper as compared to the dry paper) of the paper is very low. Preferably, it should be no more than 0.5 %, particularly preferably no more than 0.3 %.

Since the manufacture of such a paper is associated with great difficulties, a nonwoven material, also called

nonwoven wallpaper, was developed. Using such nonwovens, it is possible to meet the requirements specified above, but not all aspects of the quality are satisfactory. In particular, opacity and embossing stability are poorer as compared to paper. Processing of nonwovens is difficult since fibers may be released from the nonwoven composite during the processing steps involved in wallpaper production.

On the basis of the aforementioned, the present invention is based on the technical problem to provide a wallpaper having the desired low wet expansion without the disadvantages associated with the use of a nonwoven material.

This problem is solved with a wallpaper base containing chemical pulp, filler, chemical additives, and, as an option, groundwood pulp, by containing a fraction of man-made fibers of at least 5 wt-%.

The inventors have noticed that it is possible to use a regular paper production procedure on a paper machine with a horizontal screen to manufacture a paper with a sufficiently high fraction of man-made fibers to guarantee the desired dimensional stability. With regard to this issue, there were serious concerns amongst the experts:

- At the high operating speeds of common horizontal screen paper machines, a suitable orientation of the fibers in longitudinal and transverse direction must be achieved. In particular, it is necessary to keep the fibers from excessively orienting in longitudinal direction since this impairs the dimensional stability. Moreover, a very uniform distribution of

the fibers including man-made fibers is required in order to obtain a homogeneous paper.

- The water balance is of crucial significance for paper production. The common fiber ingredients of paper (mainly chemical pulp fibers) take up large quantities of water in the vat even before sheet formation occurs. Whereas the free water quickly flows off in the screen part of the machine, the bound water remains attached to the fibers and is removed only in the subsequent compression and drying process. This dehydration process, which is important in paper production, is disturbed significantly if man-made fibers rather than chemical pulp fibers are present in the fiber slush ("stock") guided to the screen part.
- Considerable technical problems had to be expected, in part related to the fact that man-made fibers are significantly longer than chemical pulp fibers. This complicates the obligatory cleaning and separation of interfering ingredients significantly.

The results obtained by the invention are improved further by the preferred features described in the following, which concern both the composition of the wallpaper base and the structure of a sheet material having at least two layers as well as the method of its production. The features described may be used either individually or in combination in order to generate preferred embodiments of the present invention.

All specifications of percent fractions made in the following are expressed in units of weight percent relative to the total dry mass of the mixture in question.

The predominant ingredients, in terms of quantity present, of the wallpaper base according to the invention are chemical pulp, man-made fibers, and, as an option, groundwood pulp (mechanically disintegrated wood). Typically, the sum of these fractions is at least 70 %. Preferably, the fraction of man-made fibers is lower than the fraction of chemical pulp, preferably, the ratio of man-made fiber : chemical pulp fiber is between 1:2 and 4:5. A groundwood pulp fraction is not obligatory, but particularly preferred because it not only leads to lower costs, but also has a positive impact on the quality. The groundwood pulp fraction can even be slightly higher than the chemical pulp fraction. Preferably, the mass ratio of groundwood pulp : chemical pulp is between 4:2 and 1:2.

Preferably, the fraction of man-made fibers present in the wallpaper base according to the invention should not exceed 50 %, whereby fractions of 10 % to 30 % are preferred and fractions of 15 % to 25 % are particularly preferred. At least a fraction of the man-made fibers should be fully synthetic fibers, preferably polyester fibers. It is preferable for all fractions mentioned above to be fully synthetic fibers, in particular, polyester.

The mean length of the man-made fibers should be less than 8 mm, preferably between 3 mm and 8 mm. The range from 4 mm to 7 mm is particularly preferred.

The chemical pulp fraction of the wallpaper base should be between 10 and 80 %, preferably between 20 and 60 %. The lower limit of the groundwood pulp fraction is preferably 5 %, preferably 10 %, and particularly preferably 20 %. An upper limit of the groundwood pulp

fraction of the paper of 50 %, preferably 35 %, should not be exceeded.

Aside from the three main ingredients mentioned above, the wallpaper according to the invention contains fillers and additives. As a filler, for example kaolin is added. The filler content is preferably between 5 and 20 %.

Amongst the chemical additives, the binding agent used is of major significance for the success of the invention. A polymer in the form of an aqueous dispersion has proven its utility. The polymer preferably contains an alkylacrylate, in particular butylacrylate. A copolymer of an alkylacrylate and styrene is particularly suitable.

Preferably, the chemical additives include two components with opposite charge which jointly form a binding agent system. A binding agent system of this type comprises, aside from the binding agent, an oppositely charged second component which is added after the binding agent to the stock suspension. This component causes the binding agent, which is suspended in the suspension, to precipitate onto the fibers and exert its binding effect. This component is called "oppositely charged precipitating component". Preferably, the binding agent is anionic and the precipitating component is cationic. In practical application, an epichlorhydrine resin, which also acts as a wet-strength conferring agent, has proven useful as cationic precipitating component to act jointly with an anionic binding agent.

In general, the chemical additives should include, in addition to a binding agent, a wet-strength conferring agent, preferably at a fraction of 0.5 % to 5 %. Another

advantageous chemical additive is a sizing agent at a fraction of 0.5 % to 5 %.

All components specified thus far are added to the stock suspension prior to the formation of sheets and are distributed homogeneously in the resulting paper.

The following illustration of the present invention refers to the figures. In the figures:

Fig. 1 shows a schematic cross-section of a three-layered wallpaper base;
Fig. 2 shows a material flow diagram of a procedure according to the invention;
Fig. 3 shows a detailed procedural scheme.

The wallpaper base 1 shown in Fig. 1 consists of three layers, namely a wall-facing lower layer 2 (i.e. for gluing the wallpaper to the wall), a main layer 3, and an outward-facing cover layer 4 (i.e. facing the room when the wallpaper is glued to the wall). The main layer 3 consists of a material with the properties illustrated above.

The lower layer 2 is formed by a coating applied to the main layer 3 by means of which the adhesion of the wallpaper on the wall is improved in a controlled fashion such that the wallpaper not only adheres to the wall, but also is easy to strip off the wall. Ideally, it should be possible to strip off the wallpaper completely in the dry state. These properties shall be attained (for example in DE-A-2302890) without a need to use specialized gluing techniques. Rather, the wallpaper shall be suitable for processing with conventional water-based wallpaper adhesives.

Preferably, the wall-facing lower layer 2 contains a polymer, especially a thermally-crosslinked copolymeride. In particular, an alkylacrylate copolymeride, preferably of butylacrylate, preferably polymerized with styrene has proven useful for this purpose. According to another preferred embodiment of the present invention, the layer 2 contains a wax, preferably a paraffin wax, whereby the wax fraction of the lower layer should be between 5 % and 30 %. It is also advantageous for the lower layer to contain a wet-strength conferring agent, preferably at a fraction of less than 5 %. All components of the lower layer 2 are mixed and applied to the main layer 3 using a conventional coating procedure.

The cover layer 4 preferably consists of PVC and serves as a carrier for printing.

The diagram shown in Figure 2 illustrates the procedural steps of the production method of the main layer 3. The components, chemical pulp 10, groundwood pulp 11, filler 12, and chemical additives 13 are mixed in a mixing canal 15 and then transported from there to the blend chest 16. In the preferred embodiment shown, the man-made fibers 17, preferably provided in the form of dry fibers, are added separately to the contents of the blend chest 16.

It is preferred to use fibers supplied as short sections of a fiber strand, whereby each of the sections contains a large number of fibers which, with good approximation, are equal in length (equivalent to the length of the strand sections). Surprisingly, it was found that the required individualization and homogeneous distribution of these fibers is attained particularly well when the

fibers are added in the form of the dry fibers to the contents of the blend chest 16.

Dilution water 18 is then added to the stock stream discharged from the blend chest 16. The stream then enters a stock cleaning unit 19 and is guided from there via a headbox 20 to the horizontal screen of a wire section 21. The sheet formed there is then compressed in a press section 22, subsequently dried in a drying section 23, and finally wound in a winding unit 24.

The stock cleaning unit 19 preferably contains a pressure-sorting device called "pressure screen", in which the stock runs through a slit or punched screen whose dimensions are optimized to pass the desired fiber components including the man-made fibers but retain interfering contaminations. According to another preferred embodiment, a cleaner facility effecting the desired separation of the components on the basis of their density is provided.

The coating with the lower layer 2 can be performed either online or offline. Usually, the cover layer is applied during the further course of processing.

Figure 3 illustrates a number of additional details of the preferred method, in particular with regard to the components of the binding agent system. From the mixing canal 15, the stock is transported to the blend chest 16, in which the synthetic fibers 17 are added. It is preferable to add the binding agent 13a between the blend chest 16 and a downstream stock pump 25. The pump 25 pumps the stock into a machine chest 26 and simultaneously affords good mixing of the binding agent and the other components of the suspension. The liquid

level inside the machine chest 26 is kept constant by an overflow 27 in order to provide for uniform hydrostatic pressure at the entry of the downstream pump 28 which transports the stock to the dilution water container 18. From there it is transported by means of an additional pump 29 to the cleaning unit 19. As shown, the precipitating component 13b of the binding agent system is added to the stock stream as it is discharged from the machine chest 26, whereby it is advantageous to effect this ahead of the downstream pump 28 in order to achieve good mixing.